REMARKS

Claims 1-9 are presently pending in the application.

The specification has been amended to change "rectangular battery case" at page 16, line 5 to "substantially elliptical battery case," as described at least at page 4, lines 17-25 of the specification, claims 2-3, and shown in Fig. 1. No new matter has been added by this amendment. Accordingly, reconsideration and withdrawal of the objection to "rectangular" are respectfully requested.

At the outset, the Examiner's attention is drawn to the Supplemental Information Disclosure Statement filed herewith, which cites the references cited in a Communication from the Korean Patent Office concerning the counterpart Korean Patent Application, as well as the Supplemental IDS filed May 6, 2003, citing references from a communication from the Japanese Patent Office. Acknowledgement of the two Supplemental IDSs and consideration of the cited references are respectfully requested.

In Paper No. 4, the Examiner has rejected claims 1 and 2 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,444,351 of Goto ("Goto"). Claims 3 and 6 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Goto, and claims 4, 5, and 7-9 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Goto in view of U.S. Patent No. 5,595,841 of Suzuki ("Suzuki"). Applicants respectfully traverse these rejections and the arguments in support thereof as follows, and respectfully request reconsideration and withdrawal of the rejections.

Rejections Under §§ 102(e) and 103(a) Based on Goto

Regarding claims 1 and 2, the Examiner argues that Goto discloses a cell including a negative electrode sheet comprising graphite, which is a carbon material, and a binder, thus forming a mixture which intercalates lithium. The cell allegedly includes a positive electrode sheet having an active material density of 3.6 g/ml and comprising the lithium transition metal oxide $LiCoO_2$ and polyvinylidene fluoride as a binder, which the Examiner argues are both particulate, as indicated by the term "slurry". Finally, the Examiner argues that the cell of Goto has a separator between the electrodes which contains a lithium salt. As seen in Figure 4, the cell may allegedly have an elliptical transverse-section. Therefore, the Examiner concludes that Goto anticipates claims 1 and 2.

The Examiner acknowledges that Goto does not specifically disclose the claimed length ratio of the two elliptic axes or the claimed range of the amount of binder relative to the

amount of active material, as recited in claims 3 and 6. However, since the shape of the cell would allegedly affect its compatibility with devices using current therefrom, and since the amounts of electrode components would have an effect on the capacity and mechanical stability of the electrode, the Examiner contends that determining optimal values for the ratio and the relative amounts would be within the ordinary skill in the art. Applicants respectfully traverse these rejections as follows.

The present invention is directed to a non-aqueous electrolyte secondary battery comprising a positive electrode sheet, negative electrode sheet, separator, and non-aqueous electrolyte. The positive electrode sheet contains a positive electrode mixture containing a lithium-containing transition metal oxide as an active material and a particulate binder. In comparison, the positive electrode mixture of Goto contains a positive electrode active material and a binder, which Goto generally teaches may be a known binder (col. 6, lines 48-49). In Example 1, Goto teaches a slurry containing $LiCoO_2$, graphite, polyvinylidenefluoride (PVDF) as a binder, and N-methylpyrrolidone. However, despite the Examiner's assertion to the contrary, the fact that the positive electrode mixture of Goto formed a slurry does not necessarily mean that the binder was particulate, since three components were included in the mixture in addition to the N-methylpyrrolidone solvent.

Further, Goto does not teach or suggest a particulate binder or the advantages of such. In fact, as demonstrated in the Examples of the present application, the specific binder taught by Goto, PVDF, was inferior to the claimed particulate binders in the non-aqueous electrolyte secondary battery according to the invention. Specifically, the batteries described in Examples 1-3 contained a particulate binder: an elastic copolymer comprising a 2-ethylhexylacrylate unit, an acrylic acid unit, and an acrylonitrile unit. In contrast, in Comparative Example 1, PVDF was used in place of the particulate binder. As described at page 25, the ability of PVDF to bind the active material was so weak that 4 parts by weight PVDF/100 parts by weight active material were needed to produce the positive electrode sheets. It can be seen from Table 1 that electrode sheets "M" to "O", which contained PVDF as a binder, were brittle and prone to cracking even with a large amount of binder, as shown by the critical oblateness values of 1.65-2.06. In comparison, most of the batteries according to the invention exhibited critical oblateness values greater than 2 and as high as 3.4, indicating that they were not brittle.

Additionally, the contact angles of 4.9° to 9.2° of sheets "M" and "O" show that the permeabilities of the non-aqueous electrolyte into the positive electrode mixture were too high,

causing the non-aqueous electrolyte to be distributed unevenly inside the battery and resulting in low high rate-discharge characteristics of 66-83%. In comparison, most of the batteries according to the present invention, which exhibited high rate-discharge characteristics of ~98%, had the appropriate contact angles of 19.9° to 34.6°. These results demonstrate the superiority of the claimed particulate binder over the PVDF binder taught by Goto in the non-aqueous electrolyte secondary batteries.

For all of these reasons, Goto does not teach or suggest all of the claimed elements, nor would the benefits thereof be expected based on Goto. Accordingly, Goto does not anticipate or render obvious the present invention, and reconsideration and withdrawal of the §§ 102(e) and 103(a) rejections are respectfully requested.

Rejection Under § 103(a) Based on Goto in view of Suzuki

The Examiner acknowledges that claims 4, 5, and 7-9 differ from Goto by reciting that the positive electrode binder is an elastic copolymer having units of 2-ethylhexylacrylate, acrylic acid, and acrylonitrile, or that the positive electrode also includes a conductive mixture of graphite and carbon black, in amounts relative to each other and to the active material. Claim 9 also recites the present range of the amount of binder relative to the amount of active material, a range which the Examiner considers to be obvious. Further, the Examiner argues that Suzuki discloses the present copolymer in the form of a latex, which would be elastomeric, in either or both electrodes. Since this is allegedly the same polymer as presently claimed, the Examiner contends that the claimed spectroscopic characteristics would inherently accrue. In addition, Suzuki allegedly teaches that a second polymer may be used, including one having ethylene units, and thus a polyethylene structure. The polymers provided by Suzuki are taught to provide "good cycle characteristics, a high capacity, and improved first cycle efficiency and production fitness" (Suzuki col. 1, lines 35-48). For these reasons, the Examiner concludes that it would have been obvious to one having ordinary skill in the art at the time of the invention to use the polymers of Suzuki in either of the electrodes of Goto. Also, since Suzuki allegedly teaches the polymers to be in latex and thus elastomeric form, they would allegedly be beneficial under the mechanical stresses of the spiral arrangement disclosed by Goto. The Examiner further contends that Suzuki also discloses a conducting agent for the positive electrode comprising a combination of graphite and acetylene black, and gives guidelines of the amounts in which these additives are contained in the electrode. In view of this teaching, the Examiner concludes that it would have been obvious to use as a conductive agent for the positive electrode of Goto, the combination of

graphite and acetylene black disclosed by Suzuki, and to optimize the relative amounts of the components of the resulting electrode. Applicants respectfully traverse this rejection as follows.

Goto teaches a positive electrode having an active material density of 3.6 g/ml which contains PVDF as a binder, and Suzuki teaches binders which may contain the claimed polymers. However, there is nothing in Suzuki to teach or suggest that incorporation of such binders into the positive electrode of Goto would maintain an active material density which falls within the claimed range, and neither Goto nor Suzuki teaches or suggests the criticality of the active material density in the positive electrode material.

Further, the present invention demonstrates results which would not be expected based on the proposed combination of Goto and Suzuki. The criticality of the claimed particulate binder has been demonstrated above. Additionally, the active material density is also critical to achieving the results of the present invention. Specifically, as shown in Example 2, a series of positive electrode sheets were prepared which each contained the same active material, $LiCoO_2$, and the same particulate binder, but which differed in the density of the active material. Using sheet "B", having a density of 2.9 g/ml (below the claimed range of 3.0 to 4.0 g/ml), a battery with sufficient life was not obtained. As shown in Table 1, the capacity maintenance rate, critical oblateness, and contact angle values for this battery were all lower than those batteries having active material densities in the claimed range.

Therefore, since the criticality of the particulate binder and the active material density are not taught or suggested by either Goto or Suzuki, and because the results obtained by the presently claimed batteries having a particulate binder and an active material density in the claimed range of 3.0 to 4.0 g/ml would not be expected based on either Goto or Suzuki or the combination thereof, even if a *prima facie* case of obviousness had been established, it would be overcome. Accordingly, reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

In view of the preceding remarks, it is respectfully submitted that the pending claims are patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,

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Enclosure